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Report to the Ranking Minority Member, Subcommittee on Energy, Nuclear Proliferation, and Government Processes, Committee on Governmental Affairs United States Senate

September 1986

NUCLEAR ENERGY

Environmental Issues at DOE's Nuclear Defense Facilities

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United States
General Accounting Office
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Resources, Community, and
Economic Development Division

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September 8, 1986

The Honorable John Glenn
Ranking Minority Member
Subcommittee on Energy, Nuclear
Proliferation, and Government
Processes
Committee on Governmental Affairs
United States Senate

Dear Senator Glenn:

As requested in your April 15, 1985, letter and subsequent discussions with your office, this report discusses environmental issues at nine DOE nuclear defense facilities nationwide and examines DOE's efforts to strengthen its environmental, safety, and health oversight programs. Important safety issues at these DOE defense facilities were highlighted in our report—Safety Analysis Reviews for DOE's Defense Facilities Can Be Improved (GAO/RCED-86-175, June 16, 1986). In that report, we made a number of recommendations to improve the safety review process within DOE. In this report, we are making recommendations aimed at better protecting the environment around DOE defense facilities.

Unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of its issuance. At that time, we will send copies to appropriate congressional committees; the Secretary of Energy; and the Director, Office of Management and Budget. We will also make copies available to others upon request.

Sincerely yours,

J. Dexter Peach

J. Dexter Peach
Assistant Comptroller General

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Executive Summary

Purpose

The Department of Energy's (DOE) defense operations use and generate toxic, hazardous, and radioactive material that must be handled carefully by workers not only to prevent exposure to themselves, but also to prevent its release into the environment. At the request of the Ranking Minority Member, Subcommittee on Energy, Nuclear Proliferation, and Government Processes, Senate Committee on Governmental Affairs, this report identifies key environmental issues at DOE defense facilities and evaluates the status of DOE's efforts to strengthen its environmental, safety, and health oversight programs. As agreed with the Ranking Minority Member's office, GAO focused its review on nine diverse DOE defense facilities located at seven sites around the nation.

Background

DOE is responsible for producing nuclear material for weapons and other defense purposes at 18 major sites. It is potentially one of the more dangerous industrial operations in the world. Before many of the current environmental laws were enacted, DOE and its predecessor agencies were guided by internal guidelines and standards and by the Atomic Energy Act of 1954 for pollution and radiation control. Currently, DOE and its operating contractors must comply with environmental laws such as the Clean Water Act and the Resource Conservation and Recovery Act. These laws place strict environmental control on industrial operations through permits for liquid discharges and waste disposal. DOE facilities also must comply with its own requirements in handling hazardous and radioactive material. To ensure compliance with applicable environmental laws and its own requirements, DOE has internal oversight programs. In past reports, GAO has found that DOE's internal oversight programs need to be strengthened and made more independent to ensure that DOE's operations are carried out in a safe and environmentally acceptable manner.

Results in Brief

GAO's review of nine DOE defense facilities identified a number of significant environmental issues.

- Eight facilities have groundwater contaminated with radioactive and/or hazardous substances to high levels.
- Six facilities have soil contamination in unexpected areas, including off-site locations.
- Four facilities are not in full compliance with the Clean Water Act.
- All nine facilities are significantly changing their waste disposal practices to obtain a permit under the Resource Conservation and Recovery Act.

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Principal Findings

Groundwater Contamination

Since DOE has not established standards limiting groundwater contamination, GAO compared the levels of contamination at its facilities to existing or proposed drinking water standards to provide a perspective on the degree of contamination. Eight of the nine facilities had contaminated the groundwater to levels greater than these existing or proposed standards. For example, solvents (cleaning agents) in the groundwater at DOE facilities in Colorado, South Carolina, and Tennessee were as much as 1,000 times above the proposed drinking water standard. Radioactive materials in the groundwater at DOE facilities in South Carolina and Washington State were more than 400 times greater than the drinking water standard.

DOE does not believe the contamination poses a threat to public health because it is generally confined within the facilities' boundaries. However, state officials are concerned that a potential health threat may arise. GAO noted that at three facilities the contamination has migrated to drinking water sources, which prompted remedial action by DOE. (See p. 16.)

Soil Contamination

At six of the nine facilities, soil has been contaminated in unexpected areas, including off-site locations. DOE does not believe the contamination poses a public health threat, except possibly at the Y-12 plant in Tennessee.

At the Y-12 plant, mercury has contaminated an off-site creek bed and its floodplain. In some locations, the contamination is greater than 2,000 times background levels and over 150 times greater than guidelines established by Tennessee to protect public health. In response, DOE has initiated cleanup projects and a monitoring program to identify other contaminated locations. Tennessee State officials are monitoring and assessing the situation for potential health impacts. (See p. 22.)

Environmental Compliance

All nine facilities have been issued permits under the Clean Water Act. Two of the facilities' permits, however, require DOE to complete specific pollution abatement projects. In addition, two other facilities have consistently exceeded their permit effluent discharge limits. For example,

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the N-Reactor in Washington State periodically exceeds its thermal discharge limits. To get permits under the Resource Conservation and Recovery Act, all nine facilities are changing their waste disposal practices—by closing existing disposal facilities and/or building new treatment facilities. Waste regulated under the act will be subject to outside independent inspection. However, certain portions of DOE's mixed waste—waste containing both hazardous and radioactive material—may be excluded from the permit process and continue to be regulated by DOE. (See pp. 30 and 33.)

The cost to get the nine DOE facilities into full compliance with the Clean Water Act and permits under the Resource Conservation and Recovery Act will be substantial. For example, DOE estimates that building new waste treatment facilities and closing existing disposal facilities at the nine facilities may cost over $200 million. Further, regulatory entities may require DOE to build additional facilities and/or undertake cleanup actions as a result of the permit process. For example, DOE may be required to clean up groundwater contamination at some facilities. According to DOE officials, groundwater cleanup costs could amount to hundreds of millions of dollars at a single site. Thus, the eventual cost to bring DOE facilities into full compliance with environmental laws and get the necessary permits may be over a billion dollars. (See pp. 38 and 39.)

DOE Initiatives

In September 1985 the Secretary of Energy announced several initiatives, such as conducting environmental surveys and safety appraisals, to strengthen DOE's environmental, safety, and health programs. These initiatives provide a framework for strengthening DOE's internal oversight activities. However, GAO continues to believe that outside independent oversight is important in some areas. For example, a recent GAO report in the safety area recommended outside independent reviews of DOE's safety analysis reviews. (See p. 45.)

Recommendations

GAO recommends that DOE develop an overall groundwater and soil protection strategy. Such a strategy, among other things, would provide the public and the Congress a better perspective on the environmental risks and impacts associated with operating DOE's nuclear defense facilities. GAO also recommends that DOE provide the Congress a comprehensive report on its plans, milestones, and cost estimates for bringing its facilities into compliance with applicable environmental laws. Finally, GAO recommends that DOE allow outside independent inspections of the disposal practices used for any waste DOE self-regulates and revise its order

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governing the management of hazardous and mixed waste. (See pp. 28 and 40.)

Agency Comments

GAO discussed the facts and conclusions in this report with DOE officials. Their views have been incorporated where appropriate. However, in accordance with the requester's wishes, GAO did not obtain official agency comments on this report

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Abbreviations

AEC	Atomic Energy Commission
DOE	Department of Energy
EPA	Environmental Protection Agency
ERDA	Energy Research and Development Administration
ES&H	environment, safety, and health
GAO	General Accounting Office
NPDES	National Pollutant Discharge Elimination System
ppm	parts per million
RCRA	Resources Conservation and Recovery Act of 1976

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Introduction

For over 40 years the federal government has been producing nuclear material for defense purposes. It is potentially one of the more dangerous industrial operations in the world. The operations involve not only the use of a wide variety of toxic and hazardous materials and potentially dangerous chemical processes but also the generation of vast quantities of radioactive material. Controlling nuclear reactions is another important aspect of the overall industrial complex. These operations must be carefully managed to prevent toxic, hazardous, and/or radioactive materials from entering the environment.

Nuclear Operations at DOE's Defense Facilities

The Atomic Energy Act of 1954 (42 U.S.C. 2140 et seq.) established the Atomic Energy Commission and made it responsible for making nuclear material for defense programs.[1] Under this act the Commission had regulatory control over nuclear defense facilities and the material generated.[2] The Energy Reorganization Act of 1974 (42 U.S.C. 5801) abolished the Commission and established the Energy Research and Development Administration (ERDA) with the responsibility of producing nuclear material for defense purposes. ERDA's responsibilities were transferred to the Department of Energy (DOE) pursuant to the Department of Energy Organization Act of 1977 (42 U.S.C. 7101).

The basic mission of DOE's defense activities is to produce nuclear material for weapons and naval fuel. Research, development, and testing programs for nuclear weapons and power systems is an important part of DOE's basic mission. DOE's defense mission is carried out in numerous complex steps at 18 sites around the nation.[3]

DOE defense operations begin with enriching uranium. This is accomplished at government enrichment plants where uranium-flouride gas is heated and processed to obtain products that have a higher concentration of U-235 (the fissionable isotope of uranium) than is normally found in natural uranium. Uranium that is enriched to about 3 percent U-235 is used in commercial nuclear reactors. Enriched uranium is also used for defense purposes. This enriched uranium is fabricated into

[1]The Commission was also responsible for encouraging the development of atomic energy for peaceful purposes.

[2]For the most part the facilities were government-owned and operated for the government by contractors.

[3]At some of the larger sites, such as Savannah River in South Carolina and Hanford in Washington State, many different facilities are colocated.

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nuclear fuel at DOE facilities for use in naval ships and production reactors.[4] Production reactors are nuclear reactors whose principal purpose is the production of special nuclear material. At these reactors the enriched fuel is irradiated and in the process produces various radioactive materials. Plutonium and tritium are two of the principal products produced for use in nuclear weapons.

The next important step in DOE's defense operations is the extraction of usable material from the irradiated fuel. To obtain plutonium, uranium, and other products, DOE uses large reprocessing facilities. At these facilities the irradiated fuel from production reactors is dissolved by nitric acid. Various radioactive materials, such as plutonium and uranium, are then separated from the acid solution through various chemical processes. The plutonium is sent to a facility where it is fabricated into components for weapons. Tritium, another important material used for weapons, is extracted from irradiated material in a special facility.

DOE's operations, according to DOE officials, reuse as much material as is economically practical. For example, enriched uranium recovered from spent fuel via reprocessing facilities is recycled into new fuel for use again in production reactors. Spent fuel from naval ships and even DOE test reactors is reprocessed to recover and reuse the nuclear material it contains. Plutonium is also recovered from waste produced at plutonium solidification and/or fabrication facilities.

DOE's defense operations routinely use and generate hazardous and/or radioactive materials. Some of the hazardous chemicals include acids, nitrates, various oils, reactive metals (e.g., sodium), flouride, heavy metals (e.g., mercury), beryllium, and high explosives. Exposure to some of these materials in large doses can pose immediate health threats, long-term illness, or even death. As a result, many of these materials must be handled carefully by workers not only to prevent exposure to themselves but also to prevent these materials from being released into the environment.

Some of the radioactive material, because of its lethal levels of radiation and high heat generation, must be handled with special shielded equipment to prevent worker exposure. Other material, while much less radioactive, is very toxic and can present a health hazard if inhaled or

[4]Enriched fuel is also produced for use in DOE's research reactors.

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ingested.[5] Because of their long life, many radioactive materials must be carefully stored so that they are not released in the environment. Finally, DOE operations also involve controlling nuclear reactions and handling highly fissionable nuclear material, which requires special safety systems and controls. Accidental release of radioactive material in the day-to-day operations of these facilities can also have a detrimental effect on the environment.

Protecting the Environment at DOE's Defense Facilities

It is DOE's policy to conduct its operations in an environmentally safe manner and in compliance with applicable environmental statutes, regulations, and standards. DOE orders present the basic environmental policy and program requirements for its operations. These orders include mandatory standards that are imposed by laws as well as DOE's own environmental standards. Importantly, these standards govern air and liquid emissions from DOE operations as well as handling and disposing of waste.

Air emission standards, both radioactive and nonradioactive, are established pursuant to the Clean Air Act (42 U.S.C. 7401 et seq.). DOE must meet air emission standards established by the Environmental Protection Agency (EPA) under the act. Nonradioactive air emissions standards are generally enforced by states. Accordingly, DOE contractors monitor emissions and report any violation to the appropriate state government. DOE must also keep air releases of radioactive material to standards established by EPA. DOE contractors measure radioactive air releases and report them to DOE. DOE reports them to EPA.

In regard to liquid emissions, DOE, under the Atomic Energy Act of 1954, regulates itself for the amount of radioactive material in liquid releases. Accordingly, DOE sets limits on the allowable concentration of radioactive material in liquid discharges that can be released to sanitary sewage systems and water sources outside DOE facilities. DOE requires contractors to monitor water leaving their boundaries to ensure that the amount of radioactivity it contains does not exceed DOE's concentration limits and is as low as reasonably achievable. Nonradioactive liquid releases from DOE facilities are regulated through permits from states pursuant to the Clean Water Act (33 U.S.C. 1251 et seq.). The act created the National Pollutant Discharge Elimination System (NPDES) whereby states receive authority from EPA to issue NPDES permits for

[5]Some transuranic elements—man-made elements that are heavier than uranium—pose unique health concerns if inhaled or ingested.

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nonradioactive pollutant releases. These permits establish (1) discharge limits for pollutants, (2) actions required to control releases, and (3) monitoring requirements.

DOE's defense facilities generate both radioactive and hazardous waste. Until 1984, DOE self-regulated all its waste activities. In 1984, however, a U.S. district court ruled that DOE's hazardous waste was subject to the Resource Conservation and Recovery Act of 1976 (RCRA) (42 U.S.C. 6901 et seq.). While the case involved only one facility, DOE is applying the ruling to all its defense facilities. Thus, DOE's handling and disposal of hazardous waste is now subject to EPA regulation. DOE is still self-regulating in the area of radioactive waste. A third category of waste—referred to as mixed waste—includes both radioactive and hazardous material. Regulatory authority for certain types of mixed waste is in question when it contains hazardous material, as defined by EPA under RCRA, and radioactive substances, which are exempt from RCRA. Such waste crosses the regulatory responsibilities of both EPA and DOE.

DOE uses a three-tier approach for ensuring that its operations are carried out in an environmentally acceptable manner and in conformance with environmental laws. The first tier is the contractor that actually does the work. The contractor develops its own environmental protection program and periodically checks on its implementation through internal audits and self-appraisals. The contractor has the most direct contact with the actual work and hence has a high degree of responsibility in ensuring that the work is carried out in an environmentally acceptable manner consistent with environmental laws. The second tier is the DOE field office responsible for the contractor's work. Oversight by the field office is directed toward ensuring that the contractor is following DOE's orders, regulations, and policy.

The final tier is oversight by DOE headquarters management. DOE headquarters has numerous ways of maintaining oversight. These include (1) appraising the field office's environmental protection activities, (2) reviewing plans for each field office on how it is going to carry out its respective environmental programs, and (3) reviewing accidents and unusual occurrences that happen at DOE facilities. DOE's program office (e.g., Assistant Secretary for Defense Programs) has primary responsibility for ensuring that DOE defense operations are consistent with DOE orders and regulations. DOE also has an Assistant Secretary for Environment, Safety, and Health who, among other things, provides technical advice, carries out appraisals of field offices, and serves as a focal point

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for environmental matters. While this office, in the past, acted primarily in an advisory role, recent initiatives within DOE are changing its role.

On September 18, 1985, the Secretary of Energy announced a number of initiatives to strengthen environmental, safety, and health activities within DOE. Many of these initiatives are aimed at improving environmental protection. These include (1) establishing within DOE an office of the Assistant Secretary for Environment, Safety, and Health with a Deputy Assistant Secretary for Environment, (2) revising DOE orders, (3) conducting a comprehensive environmental survey of DOE facilities, and (4) providing greater policy guidance from DOE headquarters in meeting federal and environmental laws.

Objectives, Scope, and Methodology

On April 15, 1985, the Ranking Minority Member, Subcommittee on Energy, Nuclear Proliferation, and Government Processes, Senate Committee on Governmental Affairs, requested that we review how effectively DOE is protecting worker health and the environment at its defense production facilities nationwide. As part of that request, we were asked to focus our work initially and report separately on three defense plants in Ohio. In response, we issued two reports—Information on Three Ohio Defense Facilities (GAO/RCED-86-51FS, Nov. 29, 1985), and Environment and Workers Could Be Better Protected At Ohio Defense Plants (GAO/RCED-86-61, Dec. 13, 1985). In the course of our work, we were also asked by the Ranking Minority Member's office to report separately on (1) DOE's status in implementing environmental, safety, and health initiatives announced in September 1985 and (2) DOE's safety analysis review process. Subsequently, we issued two reports—Status of DOE's Implementation of 1985 Initiatives (GAO/RCED-86-68FS, Mar. 4, 1986), and Safety Analysis Reviews for DOE's Defense Facilities Can Be Improved (GAO/RCED-86-175, June 16, 1986).

This report, as agreed with the Ranking Minority Member's office, addresses environmental issues at DOE defense facilities and DOE's overall efforts to strengthen its environmental, safety, and health programs. Because it was impractical to review all DOE defense facilities, we agreed with the Ranking Minority Member's office to focus on nine specific DOE defense facilities that reflect the diversity of DOE's defense operations. These operations include nuclear fuel fabrication, production of special nuclear material, reprocessing of nuclear fuel, fabrication and recovery of special nuclear material, and research. These nine facilities are located at seven different sites around the nation. DOE has 18 sites that are primarily devoted to nuclear defense work. We selected

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two facilities at both the Savannah River site in South Carolina and the Hanford site in Washington State because these sites have many defense facilities colocated there. The following briefly describes the nine facilities we reviewed.

- The Feed Materials Production Center, Ohio, is a foundry-type facility that processes uranium into various metal forms for nuclear fuel.
- The fuel fabrication plant, South Carolina, fabricates uranium fuel rods for use in production reactors.
- The Los Alamos National Laboratory, New Mexico, is a multipurpose research laboratory whose primary mission is to design and develop nuclear weapons.
- The Mound Laboratory, Ohio, assembles plutonium and tritium components for weapons, aerospace, and medical programs.
- The N-Reactor, Washington State, is a nuclear reactor that irradiates nuclear fuel to produce special nuclear material (e.g., plutonium).
- The reprocessing plant (H-area), South Carolina, uses chemical processes to dissolve irradiated nuclear fuel and extract nuclear material, such as plutonium, from the fuel. This facility has been operating continually since 1952.
- The reprocessing plant, Washington State, uses chemical processes to dissolve irradiated nuclear fuel and extract nuclear material, such as plutonium, from the fuel. This facility was recently upgraded and brought back into service in November 1983.
- The Rocky Flats plant, Colorado, fabricates plutonium into specific shapes for components in nuclear weapons.
- The Y-12 plant, Tennessee, fabricates high- and low-enriched uranium and other materials into finished parts and assemblies for nuclear weapons.

We began our review of DOE's defense facilities by surveying DOE's environmental, safety, and health programs at both the headquarters and field levels to identify key issues and/or problem areas associated with the operation of DOE defense facilities. At the headquarters level we reviewed DOE's orders and applicable legislation, such as the Atomic Energy Act of 1954, the Clean Air Act, the Clean Water Act, and the Resource Conservation and Recovery Act of 1976. We analyzed DOE headquarters reports, appraisals, budget submissions, and other evaluations of the nine facilities. We interviewed DOE officials in the offices of the Assistant Secretary for Environment, Safety, and Health and Assistant Secretary for Defense Programs. We also interviewed officials from other federal agencies, such as EPA and the Nuclear Regulatory Commission. At the field level, we interviewed DOE and contractor officials and

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reviewed appraisals, budget submissions, and other documents at DOE's field operations offices.

As agreed with the Ranking Minority Member's office, we focused our work on important environmental issues associated with DOE defense operations. These are

- groundwater and soil contamination,
- achieving full compliance with the Clean Water Act, and
- disposing of hazardous waste under RCRA.

In addressing these issues, we relied to a large extent on DOE-generated documents and data. We reviewed and analyzed DOE's environmental data on each of the nine facilities to determine the type, extent, and level of groundwater and soil contamination. Because DOE has not established standards specifically for groundwater at its facilities, we compared the contamination in the groundwater with existing and proposed drinking water standards to provide a perspective on the degree of contamination. Drinking water standards have been used by government agencies, including DOE, to provide such a perspective on groundwater contamination. We compared the levels of soil contamination against state or federal standards, if such standards had been established. We reviewed existing and proposed DOE permits under the Clean Water Act and Resource Conservation and Recovery Act of 1976 to determine the extent DOE is in compliance with these laws. Finally, we identified what needs to be done at these facilities in order to be in compliance with these environmental laws.

To gain a better understanding of the issues, we reviewed DOE reports, appraisals, budget documents, directives, orders, correspondence between DOE and other organizations, internal memos, and other related documents and files. We also interviewed DOE officials at headquarters, DOE field office personnel, and DOE contractors. We interviewed state officials from Colorado, New Mexico, Ohio, Oregon, South Carolina, Tennessee, and Washington. We also met with local officials responsible for environmental matters in the communities around the nine facilities. Finally, we also interviewed EPA officials at headquarters and various EPA field offices around the nation.

In addition to identifying environmental issues, we evaluated the status of DOE's September 1985 initiatives to strengthen its environmental, safety, and health (ES&H) oversight activities. We interviewed headquarters ES&H officials to determine DOE's purpose, status, and plans for each

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of these initiatives. To develop more specific information on DOE's comprehensive environmental surveys and technical safety appraisals, we reviewed DOE memoranda and plans discussing their scope, methodology, and schedules. To develop an overall perspective on the need for and potential implications of the initiatives, we relied on previous GAO and DOE reports. The GAO reports included (1) Department of Energy's Safety and Health Programs For Enrichment Plant Workers Is Not Adequately Implemented (EMD-80-78, July 11, 1980), (2) Better Oversight Needed For Safety and Health Activities at DOE's Nuclear Facilities (EMD-81-108, Aug. 4, 1981), (3) DOE's Safety and Health Oversight Program at Nuclear Facilities Could Be Strengthened (RCED-84-50, Nov. 30, 1983), and (4) Environment and Workers Could Be Better Protected at Ohio Defense Plants (RCED-86-61, Dec. 13, 1985). The DOE reports we reviewed were a May 1981 DOE task force study on operational safety and a May 1985 internal DOE study on ways to improve environmental, safety, and health activities within DOE. We supplemented our own observations of the likely impact of these initiatives with discussions with DOE officials.

We discussed the facts and conclusions presented in this report with DOE headquarters and field personnel. Factual clarifications offered by these officials were included where appropriate. In accordance with the requester's wishes, however, we did not obtain official agency comments on the report. With this exception, our work was performed in accordance with generally accepted government auditing standards. Our review was conducted between May 1985 and May 1986.

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Groundwater and Soil Contamination at Selected DOE Facilities

DOE and its predecessor agencies have, over the years, discharged and disposed of a wide variety of chemical and radioactive materials at many facilities. As a result, chemical and radioactive materials have built up in the groundwater and/or soil. At eight of the nine facilities we reviewed, the groundwater is contaminated as a result of DOE activities. At most of the facilities, the groundwater is contaminated with both hazardous waste and radioactive material. Although not as widespread, our review also showed that soil, outside of restricted burial grounds or disposal facilities, was also contaminated with radioactive and/or hazardous waste at six of the facilities we reviewed.

Groundwater Contamination

Groundwater is an important natural resource. It provides drinking water to millions of homes around the country and is the main source of water for agricultural purposes. Many industrial operations, including those of DOE, use hazardous materials. In addition, DOE defense facilities routinely deal with large quantities of radioactive materials. Proper safeguards in handling and disposing of these materials are necessary so that discharges, whether accidental or designed, do not find their way into groundwater supplies.

EPA, in August 1984, published a Groundwater Protection Strategy. Under this strategy, EPA specified guidelines for protecting different types of groundwater supplies, such as irreplaceable sources of drinking water or groundwater of limited potential use. These guidelines suggest that potentially useful groundwater supplies should be protected so that contaminants in the groundwater do not exceed background levels or drinking water standards.[1] This strategy allows some flexibility in protection, depending on various factors, such as the groundwater's likely future use.

Levels of Contamination at Selected DOE Facilities

Current and past practices in handling and disposing of hazardous and radioactive materials by DOE and its predecessor agencies have not always prevented groundwater contamination. Most of the DOE facilities we examined have contaminated, to various degrees, the groundwater beneath the facilities. Table 2.1 shows the major types of contamination that DOE has found in the groundwater resulting from plant operations at each of the facilities we reviewed. Since DOE has not established standards governing groundwater contamination at its facilities, table 2.1

[1]Drinking water standards refer to interim standards established by EPA that specify the maximum permissible level of a particular contaminant in water delivered from a public water system.

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shows the level of contamination relative to existing or proposed drinking water standards.[2] The existing standards relate to inorganic contaminants (e.g., arsenic, mercury, and nitrate) and radioactive materials. The proposed standards relate to solvents (cleaning agents) and have not yet been finalized by EPA. The following table is aimed at providing a perspective on the degree of contamination at DOE facilities. The potential health hazard the contamination may pose is discussed in the following section.

[2]Some DOE studies similarly compare groundwater contamination with drinking water standards.

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Table 2.1: Groundwater Contamination at Selected DOE Facilities[a]

Facility	Major type(s) of contamination	Level of contamination
Feed Materials Production Center, Ohio	nitrates and chloride	Nitrates and chloride have been reported above drinking water standards.
Fuel fabrication plant, South Carolina	solvents[b] and nitrates	Solvents have been reported at levels over 30,000 times the proposed drinking water standards. Nitrates have been reported at levels over 10 times the drinking water standards.
Los Alamos National Laboratory, New Mexico	none[c]	No contaminants resulting from the laboratory's operations have been reported that exceed drinking water standards.
Mound Laboratory, Ohio	tritium[d]	Although in 1976 tritium concentrations were above the drinking water standards, continual remedial actions keep the levels below the standards.
N-Reactor, Washington State	strontium-90,[e] tritium, and nitrates	Strontium-90 has been detected at levels over 400 times higher than the drinking water standards. Tritium and nitrates are slightly above drinking water standards.
Rocky Flats plant, Colorado	solvents, cadmium, and selenium	Solvents have been reported as high as 1,000 times the proposed drinking water standards. Cadmium and selenium have been detected at or slightly above the drinking water standards.
Reprocessing plant, South Carolina	tritium, nitrates, and mercury	Tritium has been reported over 2,500 times the drinking water standards. Nitrates and mercury have been detected at levels slightly above drinking water standards.
Reprocessing plant, Washington State	tritium, iodine-129,[f] and nitrates	Tritium concentrations have been reported over 25 times higher than the drinking water standards. Iodine-129 and nitrates have both been reported above the drinking water standards.
Y-12 plant, Tennessee	Solvents, nitrates, mercury, arsenic, and chromium	Solvents have been detected over 1,000 times greater than proposed drinking water standards. Nitrate concentrations have been reported at levels 1,000 times the drinking water standards. Mercury has been detected at levels 500 times the drinking water standards. Arsenic has been detected at levels 60 times the drinking water standards. Chromium has been detected at levels over 30 times the drinking water standards.

[a]The table shows only major contaminants (e.g., those that exceed existing and/or proposed drinking water standards). At many facilities other contaminants are in the groundwater above background levels.

[b]Solvents are cleaning agents, such as trichloroethylene; 1,1,1, trichloroethane; and/or tetrachloroethylene. These are classified as hazardous waste and toxic pollutants.

[c]According to DOE, at this facility arsenic and flouride occur naturally in the groundwater.

[d]Tritium is a radioactive isotope of hydrogen. It has a half-life of 12.5 years.

[e]Strontium-90 is a radioactive isotope of strontium with a half-life of 30 years.

[f]Iodine-129 is a radioactive isotope of iodine with a half-life of over 15 million years.

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As table 2.1 shows, groundwater at eight of the nine facilities we reviewed is contaminated with various radioactive and/or chemical materials as a result of the facilities' operation. In some cases solvent contamination exceeds proposed drinking water standards by a factor of 1,000 or more. In other cases, the radioactive material in the groundwater is more than 400 times greater than the drinking water standards.

While DOE officials have not determined all sources of the contamination at all of the facilities, for many facilities a major source appears to be their waste disposal practices. For example, at the reprocessing plant in South Carolina, liquid waste is disposed of in a seepage basin.[3] Seepage basins are shallow earthen excavations used to receive low concentrations of chemical and radioactive waste. The liquid effluents seep down through the sides and floor of the basin. During seepage, the liquid waste loses some of its contaminants, which either combine with the soil, remain in the basin, or, if radioactive, decay. Some contaminants, however, reach the groundwater and can migrate with it. The seepage basin at the reprocessing facility is, according to DOE, the major cause of the nitrate groundwater contamination around the facility. A seepage basin for the fuel fabrication plant in South Carolina is believed to be a cause of the solvent contamination in the groundwater near that facility. A similar source appears to be the primary cause of contaminated groundwater at the reprocessing facility and the N-Reactor in Washington State. At these facilities, cribs are used to dispose of liquid waste in a manner similar to seepage basins.[4] Contaminants—tritium and nitrates—entered the groundwater, according to DOE officials, by seeping down and out of the cribs and trenches. Besides seepage-type basins, burial grounds at DOE facilities can be another major source of contamination. In this regard, rainwater can wash the contaminants out of the soil when it percolates down through the ground or flows over the soil. DOE believes that some groundwater contamination at the Mound plant, Ohio, and Y-12 plant, Tennessee, has resulted in this manner.

Health Threat Posed by the Contamination

Some of the contaminants in the groundwater around DOE facilities are suspected or known carcinogens. Others are poisonous. Hence, a health threat can be created if the contaminants migrate into drinking water supplies.

[3]They are sometimes called settling ponds.

[4]Cribs are typically long, rock-filled trenches covered with a sheet of plastic and several feet of dirt. They are designed to allow liquids to penetrate into the underlying soil.

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DOE officials do not believe the groundwater contamination at the facilities poses a threat to public health. At some facilities, they pointed out that the contaminated water is confined under federal property. For example, at the Rocky Flats plant in Colorado, and both the fuel fabrication and reprocessing plants in South Carolina, DOE officials told us that the contaminated groundwater is underneath the facilities' boundaries. At other facilities where contaminated groundwater has migrated off-site, according to DOE officials, it quickly becomes diluted or dissipated to the point where it poses no health hazard even if it is used. For example, at the Hanford site, nitrates, tritium, and strontium-90 have migrated through the groundwater into the Columbia River (a site boundary) at levels that exceed drinking water standards.[5] However, the dilution effect of the Columbia River is so great that soon after the contaminants enter the river, the contaminants are well below drinking water standards. Finally, at the Y-12 plant in Tennessee, DOE officials told us they are studying the extent that the groundwater is migrating and have found no evidence yet that it is a threat to public health.

Although the groundwater contamination does not appear to pose an immediate threat to public health, some problems have already occurred. An off-site drinking well near the Feed Materials Production Center in Ohio became contaminated with uranium. DOE dug a new well and is sampling other off-site drinking wells to reassure the public that the problem is not spreading. An on-site drinking well also has become contaminated with tritium at DOE facilities in Washington State, and two on-site drinking wells at DOE facilities in South Carolina have become contaminated with solvents. The solvent contamination exceeded proposed drinking water standards and, as a result, the wells are not being used as a source of drinking water. They are used only for industrial processes. Another problem that has occurred is the contamination of drinking water aquifers at both the Mound plant in Ohio and the fuel fabrication facility in South Carolina.[6] At both facilities DOE has operations underway to dilute and/or remove the contamination.

Some state officials expressed concern over possible future problems and the continued contamination of the site. State officials from Colorado, Tennessee, Washington, and South Carolina all told us that

[5]Both the N-Reactor and reprocessing plant in Washington State are located on the Hanford site.

[6]An aquifer is an underground geologic formation containing water.

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groundwater movement either laterally and/or downward at DOE facilities in their respective states is not precisely known. Some contamination could eventually migrate off-site and affect the use of water for agricultural or domestic purposes. As a result, many state officials told us that they are monitoring the situation and gathering more information to better characterize the groundwater contamination so that the seriousness of the issue can be better judged.

DOE Efforts to Resolve Groundwater Contamination

DOE does not have an overall DOE groundwater protection strategy. For the most part, actions and plans to address the contamination appear to be developed on a case-by-case basis at each facility. In general, actions taken by DOE consist of (1) better characterizing the type, level, and movement of the contamination, (2) eliminating or reducing the sources of contamination, and (3) undertaking cleanup projects to lower the level of contamination in some cases.

At all the facilities we reviewed, DOE has groundwater monitoring efforts underway. At many facilities these efforts are being expanded—more wells are being drilled—to better characterize the scope, degree, and movement of the contamination. DOE officials also told us that continual efforts are underway at their facilities to study the movement of the contaminants in the groundwater.

The possible sources of contamination have been examined by DOE once the contamination was found. At some facilities, such as the Feed Materials Production Center and Mound Laboratory in Ohio and the fuel fabrication plant in South Carolina, actions have been taken to eliminate sources of contamination. For example, the seepage basin at the fuel fabrication plant has been closed. At other facilities, such as the Y-12 plant, disposal facilities will be upgraded or discontinued to reduce contaminants in the groundwater. At the reprocessing plant and N-Reactor in Washington State, efforts are planned to modify some waste streams in order to reduce the amount of waste discharged into the ground.

In addition to better characterizing the issue and eliminating the sources of contamination, DOE has taken action to reduce the contamination already in the groundwater at two of the facilities we reviewed. At the Mound plant in Ohio, DOE is diluting the tritium contamination to below drinking water standards. For the fuel fabrication plant in South Carolina, DOE is pumping contaminated groundwater from 11 recovery wells to an air-stripping unit, which removes the solvent from groundwater.

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In both cases the cleanup action was undertaken because the contamination had reached known drinking water aquifers. At other DOE facilities, no efforts are being undertaken to clean up the contaminants already in the groundwater.

Contaminated Soil

Many DOE facilities, through routine practices or accidents, have deposited potentially dangerous materials into soil around the plant site. Over the years such material can build up in the soil and present a potential health threat. For example, the contaminated soil can be washed off-site by rainwater or percolate down into groundwater.

DOE has no specific guidelines or standards for soil contamination around its facilities. However, on a case-by-case basis, DOE will establish standards and/or concentration limits for cleaning up accidents and decommissioning facilities. In general, standards are established for a specific cleanup project, taking into account a number of factors, such as the type of contamination, future use of the land, and cost of cleanup. In some cases, such as spills, all of the contaminated material is removed. In other cases, specific concentration guidelines are established and actions are taken to clean up the site to those guidelines.

Levels of Contamination at DOE Facilities

Soil can become contaminated at DOE facilities as a result of a designed practice (planned) or through accidents (unplanned). At many of the facilities, the soil in the waste burial grounds and/or in disposal facilities has become contaminated. This is because the soil was intended or designed to act as a barrier to keep the waste from migrating. DOE officials told us that such areas are restricted in use and monitored regularly to determine whether the contaminants are migrating. They also told us that when the burial grounds and disposal facilities are closed, they plan to take whatever action is necessary to immobilize the waste so it will not lead to future environmental problems.

In addition to soil contamination in and around disposal facilities and burial grounds, we noted that at six of the nine facilities, soil has been contaminated in areas not predesigned to become contaminated. In four instances the contaminated soil has moved off-site. Table 2.2 shows unplanned soil contamination at the six facilities.

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Table 2.2: Soil Contamination at Selected DOE Facilities

Facility	Description of unplanned soil contamination
Feed Materials Production Center, Ohio	Elevated levels of uranium both on- and off-site. Data indicate that elevated levels are, in some places, more than 10 times background levels.
Mound Laboratory, Ohio	Elevated levels of plutonium both on- and off-site. Data indicate that the levels are, in some instances, more than 100 times background levels.
Rocky Flats plant, Colorado	Elevated levels of plutonium both on- and off-site. Data indicate that the levels are, in some places, more than 50 times background levels.
Reprocessing plant, South Carolina	Elevated levels of plutonium on-site. Levels recorded were slightly higher than 10 times background levels. Soil under a high-level waste tank has become radioactive.
Reprocessing plant, Washington State	Soil under some high-level waste tanks has become radioactive.
Y-12 plant, Tennessee	Off-site mercury contamination greater than 2,000 times background levels has been recorded.

The sources of contamination vary somewhat from facility to facility. The plutonium soil contamination at both the Rocky Flats and the reprocessing plant in South Carolina, according to DOE officials, is from effluent releases over the years. The plutonium soil contamination at the Mound plant is from a pipeline rupture. The radioactivity in the soil under the waste tanks for the reprocessing plants in South Carolina and Washington State are the results of accidental leaks and spills. Finally, according to DOE officials, the off-site uranium and mercury contamination at the Feed Materials Production Center and the Y-12 plant, respectively, are believed to be, in part, the result of rainwater runoff from the plants.

Health Threat Potential and DOE Efforts to Address the Contamination

At what level contaminants in the soil pose a health threat is difficult to determine because it would depend on how the soil is used and/or whether the contamination can migrate from the soil. Some of the more immediate concerns are that the contaminants could get into water supplies and be consumed and/or built up in aquatic life. Also, the soil can be disturbed in such a manner that the contaminants are exposed and suspended in the air where they could be inhaled.

Except possibly for the mercury situation at the Y-12 plant in Tennessee, DOE does not believe soil contamination poses a threat to public health. Nevertheless, DOE has planned soil cleanup at two of the facilities and will continue to monitor and assess the soil contamination at all its facilities to be assured that no health threat will occur.

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At the Feed Materials Production Center in Ohio, uranium concentrations have been found at levels greater than 10 times background levels both on- and off-site. According to DOE officials, the contamination is near the facility's boundary and probably has resulted from rainwater runoff and air releases from a formerly-used incinerator. According to DOE officials and the facility's environmental reports, no health hazards are associated with the contamination. DOE has recently executed a Federal Facilities Compliance Agreement with EPA, which commits DOE to conduct a site-wide characterization of the contamination and to undertake necessary remedial action.

At the Mound Laboratory in Ohio, plutonium concentrations that were higher than expected were found in the soil on-site and in the sediment of an abandoned off-site canal. After an investigation, Mound officials determined that these deposits resulted from a 1969 pipeline rupture. The site of the rupture has been cleaned up. According to Mound officials, the off-site contamination could become a health threat only if, as part of a construction project, the soil was dug up, allowed to dry, and then become suspended in the air. No such construction projects are planned in the area. The city near Mound has agreed to notify the laboratory if the land is developed. Mound also plans to continue monitoring the situation.

Radioactive soil under the high-level radioactive waste tanks in South Carolina and Washington State have resulted from spills and/or leaks in the tanks. DOE officials told us that the contamination is localized and in a restricted-use area and, as a result, poses no threat to the public. They believe it is very unlikely that the soil will migrate to any significant degree. Finally, they told us they are continually monitoring the situation to identify any migration or contamination buildup in the soil.

Elevated levels of plutonium have been found in the soil around the Rocky Flats plant. DOE's site monitoring program has reported elevated levels around the facility's boundary. Elevated levels were also found off-site on land adjacent to the facility. Finally, elevated levels have been found in sediment at the bottom of reservoirs near the plant. Although DOE has no guidelines for plutonium concentrations in soil, the state of Colorado has a plutonium standard for soil.[7] Some samples taken on- and off-site exceeded the state's standard. DOE officials, however, do not believe the contamination poses a health threat. They told

[7]The Colorado standard is approximately 1 picocurie per gram. A picocurie is a measure of the amount of radioactivity emitted by a substance.

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us that the radiation effect on the public would be negligible even if the areas contaminated were available for public use. The off-site land that was contaminated has been purchased by the federal government and DOE plans to undertake remedial action on the property to reduce the level of contamination. DOE officials told us that plutonium in the sediment of the reservoirs is stabilized and is below the surface sediment. As a result, they do not believe the situation is a health threat.[8]

Large amounts of mercury used at the Y-12 plant were lost to the environment during the late 1950's and early 1960's.[9] As a result, a creek bed and its floodplain became contaminated with the mercury. Elevated levels of mercury were also found in the Clinch River. To complicate matters, in the early 1980's, dirt was taken from the flood plain and used in and around the neighboring town of Oak Ridge. For instance, it was used as top soil in the construction of a civic center and water sewer system for the town.

DOE, through soil monitoring programs, has found that some locations in the creek bed and its floodplain contained levels of mercury thousands of times the normal levels. Readings as high as 2,000 parts per million (ppm) were recorded according to DOE officials. DOE also found that the soil used at the civic center and water sewer system had contamination levels that were, in some instances, over 500 ppm. To protect human health, the state of Tennessee in 1983 issued a guideline level for mercury in soil of 12 ppm.

In response to the situation, DOE has taken a number of steps, including

- on-site projects to reduce mercury migration off-site,
- a cleanup project at the civic center to reduce the level of mercury in the soil,
- an extensive program to monitor known contaminated soil locations and identify other contaminated locations, and
- the establishment of an interagency task force to oversee DOE actions and recommend new actions.[10]

[8]DOE has recently signed an agreement with EPA and the state of Colorado that commits DOE to a site-wide investigation of all contamination, including off-site soil.

[9]DOE has estimated that over two million pounds of mercury used at the Y-12 plant is unaccounted for and about 35 percent (.7 million pounds) may have been lost to the environment.

[10]The interagency task force includes representatives from DOE, EPA, the state of Tennessee, the town of Oak Ridge, and the Tennessee Valley Authority.

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DOE officials told us that they will, over the next few years, undertake a number of projects, including reducing mercury discharges to surface streams and soil cleanup in waste management areas. They also added that they are funding extensive evaluations of the problems as part of the interagency task force. In this regard, a recent in-stream contaminant study (January 1986) by the Office of Natural Resources and Economic Development, Tennessee Valley Authority, found that substantial amounts of mercury are still migrating through the creek and onto the floodplain, and that elevated levels of mercury have been found in aquatic life in the creek and the Clinch River. The study recommended, among other things, that the contaminated creek be closed to fishing and warning signs be placed to alert the public of potential health risks. The study also made a number of other recommendations aimed at developing a comprehensive action plan to identify and reduce those areas with high concentrations of mercury.

Although mercury occurs naturally in the environment, large doses can cause acute poisoning and lower doses over extended periods can cause chronic poisoning. According to DOE officials, medical records and interviews with private physicians in the area have not shown any indications of mercury poisoning of the public. A pilot study, dated October 1985, by staff from the Tennessee Department of Health and Environment and the Centers for Disease Control, found that it is unlikely people now exposed to contaminated soil are at risk for developing significantly higher mercury levels than unexposed populations. DOE is continuing to examine the potential health threat. For example, DOE is funding a study of the short- and long-term health effects of mercury exposure to workers. This study, which is planned to end in late 1986, is being undertaken with oversight from the National Institute of Occupational Safety and Health.

Conclusions

In operating many of its defense facilities, DOE has contaminated the groundwater underneath its facilities. Not only does the contaminated groundwater contain many radioactive and hazardous materials but it is also contaminated to very high levels—in some cases thousands of times drinking water standards. In addition, the contaminants, in some cases, have migrated off-site (e.g., uranium contamination at the Feed Materials Production Center) or into rivers (e.g., tritium contamination at the N-Reactor). At many facilities DOE is still attempting to determine and better understand the migration patterns of the groundwater as well as sources of contamination.

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DOE does not have an overall groundwater strategy that specifies the extent to which groundwater underneath its facilities can become contaminated. Moreover, many of its older disposal operations (e.g., seepage basins), as designed, allow groundwater contamination. Some of these operations, such as cribs at the reprocessing facility in Washington State, will continue to further contaminate the groundwater. Thus, in our view, DOE, in the absence of any strategy or policy, has allowed the continuing contamination of groundwater at some of its facilities. On the basis of the facilities we reviewed, only when the groundwater clearly threatens drinking water supplies, such as drinking wells and/or known drinking water aquifers, has DOE taken action to clean up the contamination.

Soil contamination at DOE facilities does not appear to be as widespread as groundwater contamination. However, we believe the situation DOE faces at the Y-12 plant is, in part, the result of a lack of guidance in regard to the extent that soil can be contaminated. In this regard, mercury has been allowed to wash off the ground of the facility for years through a creek and into a nearby river.

In our view, we believe DOE can benefit by developing an overall groundwater and soil protection strategy. Such a strategy should establish a DOE-wide policy on the extent that groundwater and soil can become contaminated, and include, to the extent practical, specific guidelines for protecting the environment from radioactive and hazardous materials. DOE managers would then have a clearer understanding of how their respective facilities should operate to limit groundwater and soil contamination. DOE managers would also be able to assess the current situation at their facilities against DOE policy, which would help prioritize, as well as highlight, any needed corrective action. An overall strategy should provide the public and the Congress a better understanding of the environmental risks and impact associated with operating DOE's nuclear defense facilities. We believe the strategy, at this time, should be flexible enough to adjust to the unique operations carried out at DOE defense facilities, the various locations of these facilities, and future regulatory constraints that may be imposed as a result of environmental laws.

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Recommendation

We recommend to the Secretary of Energy that DOE establish a groundwater and soil protection strategy. Such a strategy should reflect DOE policy on the extent groundwater and soil can become contaminated and include specific guidelines, to the extent practical, to protect groundwater and soil around DOE facilities.

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Effluent Releases and Hazardous Waste Disposal at Selected DOE Facilities

It is DOE's policy to conduct its operations in compliance with applicable environmental statutes, regulations, and standards. Our review of nine DOE defense facilities disclosed that (1) four are not in full compliance with the Clean Water Act and (2) none have final permits for disposing of waste under the Resource Conservation and Recovery Act (RCRA). To bring the facilities we reviewed into full compliance with the Clean Water Act and get final RCRA permits, DOE plans to change many of its waste handling and disposal practices.

Achieving Full Compliance With the Clean Water Act

The Clean Water Act is the principal law governing the discharge of liquid effluents (e.g., metals, organic compounds, phosphates, and/or nitrates) from DOE facilities into streams, rivers, etc.[1] Under the law, EPA establishes overall water discharge standards and either EPA or states, when delegated authority, implement and enforce the standards. The principal tool used to regulate liquid effluents is the National Pollutant Discharge Elimination System (NPDES) permit process. Under this process a permit is issued, usually by the state, for a specific facility or group of facilities. In general, permits will specify concentration limits for various pollutants and monitoring requirements. The permit may also require the owner of the facility to take action(s) to control certain releases and specify a time frame in which the facility must comply. Such stipulations to a permit are referred to as a compliance schedule. NPDES permits are for 5-year periods and must be reissued thereafter.

All nine facilities we reviewed have been issued NPDES permits. However, four facilities are not in full compliance with their NPDES permits. These facilities are the Feed Materials Production Center and the Mound plant in Ohio, the N-Reactor in Washington State, and the Y-12 plant in Tennessee. The following sections describe the compliance situation at these facilities.

Feed Materials Production Center, Ohio

The Feed Materials Production Center was issued an NPDES permit by Ohio in 1980. This permit contained a compliance schedule requiring DOE to construct a sewage disinfection facility, water runoff control trough, water retention basin, and a nitrate removal plant. DOE has completed the first two projects. The remaining two projects—the retention basin and the nitrate removal plant—which were required by the permit to be built by April 1984, are not operational. DOE officials told us that both

[1]The Clean Water Act regulates nonradioactive liquid releases at DOE facilities. Radioactive liquid releases are regulated by DOE under the Atomic Energy Act.

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facilities should be completed by September 1986 at a cost of $6.4 million.

Currently, the facility is operating under an administrative extension of its expired permit while the new permit is being considered by state officials. DOE officials told us that any new permit would likely contain another compliance schedule because the new nitrate removal plant may not be able to handle all nitrate effluents discharged. DOE's Oak Ridge National Laboratory conducted tests that indicate treating the waste will be more difficult than originally anticipated. DOE officials are considering building another facility so the plant can be in full compliance with its NPDES permit.

Mound Laboratory, Ohio

The Mound Laboratory was issued an NPDES permit in 1985 from Ohio. Although the permit did not contain a compliance schedule, the laboratory has exceeded its permit limitations many times for suspended solids (mud) discharged into the Great Miami River, which is adjacent to the plant. During fiscal year 1984, Mound exceeded its NPDES permit for suspended solids on 58 occasions. These permit violations occurred, for the most part, during heavy rains. Although Ohio state officials do not believe the situation is a major problem because the mud is quickly diluted in the river, they have requested corrective actions to be taken.

DOE, in its 1987 budget, is requesting $4.3 million to correct the situation at the Mound plant. These funds will be used to eliminate process water from entering the storm drainage system at the plant and to upgrade the sanitary and storm sewer system on-site. These projects are scheduled to be completed by June 1989. DOE believes these projects will enable the Mound plant to stay within its NPDES permit limitations.

N-Reactor, Washington State

The N-Reactor was issued an NPDES permit by EPA as part of the Hanford site in December 1981.[2] This permit contained a compliance schedule for the N-Reactor that required DOE to complete a detailed study documenting the extent and nature of the thermal plume formed in the Columbia River by N-Reactor cooling water discharges. Further, the compliance schedule required that if the study showed that the thermal plume was not in compliance with state standards, by June 30, 1985, DOE was to either develop a plan to come in compliance or submit to EPA a thermal discharge variance request.

[2]This permit covers all DOE facilities at the Hanford site.

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In May 1984 DOE completed the required study, which showed that thermal discharges were not in compliance with Washington State's regulations at certain times during the year (when the river is low and the temperature of the river is high). DOE also proposed a compliance plan, which consisted of expanding the area in the river where the thermal plume is allowed to mix with the cooler river water (the mixing zone). DOE argued that expanding the mixing zone would produce no significant adverse impact to fish near the N-Reactor or disproportionately diminish aesthetic values or other beneficial uses of the river.

DOE's compliance plan was initially rejected. In general, both EPA and Washington State officials pointed out that they use the existing mixing zone definition extensively and that relaxing the definition for DOE would have adverse ramifications for other permits. For example, if DOE's proposal was adopted, the state might have to relax the regulations for other industries if they raise similar arguments.

The NPDES permit covering the N-Reactor expired and has not yet been renewed pending the resolution of this issue. The N-Reactor is allowed to operate under an extension of the old permit while state officials reevaluate DOE's study of the effects of changing the boundaries for the area in which the thermal plume is allowed to mix. Both DOE and the state are examining alternatives, which include building cooling water facilities. According to DOE officials at the Hanford site, the capital cost associated with building cooling water facilities would be about $150 million.

Y-12 Plant, Tennessee

EPA issued the Y-12 plant an NPDES permit in May 1985. The new permit is the result of negotiations between DOE, Tennessee, and EPA. The permit contains a compliance schedule aimed at resolving the following major problem areas:

- the runoff from a coal pile at the facility into a nearby creek,
- the elimination and/or treatment of waste discharged from numerous pipes at the facility, and
- eliminating the leakage of various pollutants from disposal areas into a nearby creek.

To correct these problems, numerous facilities are planned to be built, including a steam plant wastewater treatment facility, a sanitary wastewater treatment facility, and treatment facilities for handling processed waste (e.g., nitrate, uranium, etc.) directly from the Y-12 plant. Projects

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to reduce leakage from disposal areas will also be undertaken. DOE estimates that it will cost over $50 million to bring the Y-12 plant into full compliance with its NPDES permit by 1990.

Disposal of Hazardous Waste Under RCRA

DOE and its predecessor agencies have been generating radioactive and hazardous waste for over 40 years. The management, storage, and disposal of this waste has been regulated, for the most part, by the generators (DOE and its predecessor agencies). DOE Order 5480.2, dated December 13, 1982, established procedures for regulating hazardous waste at its facilities and requires its facilities, to the extent practicable, to follow regulations issued by EPA pursuant to RCRA. DOE also required that mixed waste—waste containing both radioactive and hazardous material—be managed under an equivalent degree of protection to that afforded by EPA regulations for hazardous material.

In 1984 DOE's self-regulation of all its waste ended when a U.S. District Court in Tennessee ruled that nonradioactive waste produced by DOE was not exempt from RCRA. While this case involved only one facility, DOE extended the ruling to all its defense facilities, thus making them subject to EPA regulations under RCRA. Under RCRA, DOE facilities must have a permit to generate, store, and dispose of hazardous waste. In order for DOE to get permits for its facilities, it has and is changing its waste disposal practices.

DOE's Planned Disposal Practices for Selected Facilities

Under RCRA, a generator of hazardous waste that treats, stores, or disposes of such waste must obtain a permit. The permit process consists of two parts—A and B. In submitting a part A application, DOE identifies its facility as a generator of waste, specifies the type and amount of waste generated, and describes the process that will be used to treat, store, and dispose of the hazardous waste. In general, a facility is allowed to operate on an interim basis until part B is submitted and approved. The part B permit provides more detailed specifications outlining what the facility must do to comply with EPA regulations governing hazardous waste treatment, storage, and disposal.

Table 3.1 shows, for each of the facilities we reviewed, the status of the RCRA permit and describes in general the disposal practice(s) DOE plans to use.

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Table 3.1: Status of the RCRA Permit and Planned Disposal Practices at Selected DOE Facilities

Facility	Permit status and planned disposal practices
Feed Materials Production Center, Ohio	The part B application was submitted in Nov. 1985. Hazardous waste will be sent to a commercial disposal operation. Some mixed waste will be processed off-site to make it nonhazardous and disposed of as radioactive waste. Other mixed waste will be stored and/or treated. DOE has not specified a disposal plan for this waste.
Fuel fabrication plant, South Carolina	The part B application was submitted in Feb. 1985. DOE has closed the seepage basin at the plant that was used for many years to dispose of hazardous and mixed waste.[a] The waste currently generated is being treated and temporarily stored. Eventually, DOE plans to solidify the waste prior to disposal.
Los Alamos National Laboratory, New Mexico	The part B application was submitted in Oct. 1985. Hazardous waste will be incinerated or shipped off-site to a commercial disposal operation.[b] Some mixed waste will be incinerated and handled as radioactive waste. DOE also plans to close its existing hazardous burial grounds.
N-Reactor, Washington State	The part B application was submitted in Nov. 1985. Solid hazardous waste will be sent to a commercial waste operation.[a] All major liquid waste streams, according to DOE, are either nonhazardous or exempt from RCRA. DOE is not attempting to get a RCRA permit for disposal of this waste.
Mound Laboratory, Ohio	DOE officials are awaiting notification from the state to submit a RCRA part B permit for this site. Hazardous waste will go to a commercial disposal operation and mixed waste will be sent to another DOE facility for treatment and disposal.
Rocky Flats plant, Colorado	The part B application was submitted in Nov. 1985. DOE plans to close the existing solar evaporation ponds on-site that have been used to dispose of waste. Hazardous waste will be shipped to a commercial disposal operation. Mixed waste will be treated and stored. Eventually DOE plans to ship this waste off-site for disposal at another DOE facility.
Reprocessing plant, South Carolina	The part B application was submitted in Feb. 1985. DOE plans to close the existing seepage basin, which currently receives mixed waste, in 1988.[a] The waste generated after 1988 will be treated and stored until a solidification facility can be built.[c]
Reprocessing plant, Washington State	The part B permit was submitted in Nov. 1985. Solid hazardous waste will be sent to a commercial waste operation.[a] All major liquid waste streams, according to DOE, are either nonhazardous or exempt from RCRA. DOE is not attempting to get a RCRA permit for disposal of this waste.[c]

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Facility	Permit status and planned disposal practices
Y-12 plant, Tennessee	The part B permit was submitted in Nov. 1985. Existing disposal areas—which handle hazardous waste—will be closed. Hazardous waste will be sent to a commercial disposal operation. DOE plans to treat some mixed waste to make it nonhazardous and then dispose of it as radioactive waste. Other mixed waste will be stored and/or treated. DOE has not specified a disposal plan for this waste.

[a]Some solid hazardous waste will be sent to a centralized storage facility, treated if necessary, and then sent to a commercial disposal operation.

[b]Some hazardous waste (explosives) will be vented or detonated.

[c]All high-level radioactive waste generated at these facilities was not included in the RCRA application.

At some DOE facilities the planned disposal practices reflect major changes in DOE's disposal of waste. In general, these changes can be classified as building new treatment and storage facilities and closing existing disposal facilities. These changes will cost tens of millions of dollars. For example, DOE officials in South Carolina estimate it will cost about $50 million to build a treatment plant for waste generated at the reprocessing plant. DOE officials in South Carolina also estimate it will cost $21 million to build a facility to solidify waste sludge at the fabrication facility. For the Y-12 plant and the Feed Materials Production Center, DOE estimates spending about $30 million for an incinerator, which will reduce the volume of the waste and make some waste nonhazardous. Many millions more will be spent to close existing disposal facilities. These funds will be necessary primarily to clean up and/or stabilize waste that was previously disposed. For example, DOE officials in South Carolina told us it may cost about $30 million to close each of the seepage basins used to dispose of waste from the fuel fabrication and reprocessing facilities. At the Y-12 plant, DOE officials estimated that it will cost over $20 million to close the major disposal sites. At Rocky Flats, DOE officials told us that it will cost $8 million to close the solar evaporation ponds used in disposing of hazardous and mixed wastes. Finally, DOE officials at Los Alamos told us they estimated it will cost $12 million to close some of its hazardous and mixed waste burial grounds.

Key Questions That Need to Be Answered

As with other permitting processes, such as the NPDES process, DOE may be required to change its planned disposal practices either before getting its final RCRA permit or as a requirement of the permit. On the basis of our review, we identified two key questions that must be worked out between DOE and EPA and the appropriate state governments:

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- Is DOE's groundwater monitoring program and protection adequate at its facilities?
- Will some portion of DOE's mixed waste be exempt from RCRA regulation?

Both questions have important budgetary implications.

Groundwater Monitoring and Protection

Groundwater protection is an important aspect of the RCRA process. Under RCRA, owners and operators of hazardous waste treatment, storage, or disposal facilities will be required to meet established limits for hazardous material in groundwater and have adequate monitoring systems to detect the level, if any, of contaminants in the groundwater and their migration pattern. In general, concentrations of hazardous materials must not exceed background levels of that material in the groundwater. If, at the time of the permit application, the groundwater has been contaminated, the owner or operator is required to submit information during the permit process, establishing a corrective action program or demonstrating that higher concentration limits will not pose a "substantial present or potential hazard to human health or the environment".

Of the nine facilities we reviewed, eight have contaminated the groundwater with various hazardous and/or radioactive materials. Many of the facilities have contaminants in the groundwater that are hazardous. Although DOE has ongoing projects to remove some contaminants and reduce the discharge of contaminants into the groundwater, DOE does not have plans to clean up the groundwater at any of the facilities to background levels.

Some state officials we contacted were concerned about future health problems that may arise. In this regard, they are concerned because they do not have sufficient information to enable them to fully consider the potential health hazards of groundwater contamination. For example, state officials from the Colorado Department of Health told us that because of limited information on groundwater contamination at the Rocky Flats site, the risk to public and environment cannot be assessed. State officials from South Carolina and Tennessee expressed similar concerns about DOE facilities in their states. To provide the necessary information, DOE may have to expand its groundwater monitoring program. Many of the facilities we reviewed have been either cited for inadequate groundwater monitoring programs or requested by the state to provide more information in regard to groundwater contamination.

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Once the appropriate state governments and/or EPA officials have sufficient information, a determination must be made of the potential health hazards that exist. Under RCRA, DOE could be forced to clean up the groundwater contamination to specific limits set forth in the permit. Such actions can be very costly. For example, according to DOE officials at Oak Ridge and Savannah River, the cost to clean up groundwater at their respective sites could easily amount to hundreds of millions of dollars.

Regulation of Mixed Waste

Mixed waste contains both radioactive and hazardous substances. Under the 1984 district court decision, DOE's hazardous waste is subject to EPA regulation under RCRA. RCRA, however, excludes from regulation in its provisions certain types of nuclear material—source material (e.g., uranium), special nuclear material (e.g., plutonium), and byproduct material (radioactive material—except special nuclear material—yielded or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material). Since some of DOE's mixed waste includes source, special, or byproduct nuclear material, the question of who regulates this mixed waste has arisen.

DOE is attempting to resolve this question by developing a rule that would establish which mixed waste is subject to RCRA and which DOE would exclusively regulate. This rule was published for public comment in November 1985 in the Federal Register. Under DOE's draft rule, DOE would regulate mixed waste generated as a direct consequence of making special nuclear material. For example, all waste now stored in high-level waste tanks would be regulated exclusively by DOE. Other mixed waste, such as radioactive contaminated solvents from cleaning equipment, would be regulated under RCRA. Inherent in the DOE proposed rule was the belief that the radioactive hazard of byproduct waste would dominate the chemical waste hazard. Until this question is resolved, DOE has directed its field offices to include in its part B application only the mixed waste that it believes is clearly subject to RCRA.

All of the nine facilities we reviewed generate various forms of mixed waste. At five of the facilities, according to DOE officials, some of the mixed waste generated is a direct consequence of making special nuclear material and, therefore, not subject to RCRA under DOE's proposed rule. Accordingly, the RCRA permit applications submitted by DOE for five facilities—the reprocessing plant and N-Reactor in Washington State, the Mound Laboratory in Ohio, the reprocessing plant in South Carolina, and the Y-12 plant in Tennessee—do not include some mixed waste

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storage or disposal activities. For example, high-level radioactive waste containing nitric acid, which is generated and stored at DOE reprocessing plants in South Carolina and Washington State, has not been included in DOE's RCRA permit applications.

Some state officials may not agree with DOE's making a determination regarding what portion of DOE's mixed waste will be covered by a RCRA permit. For example, Washington State officials are concerned that DOE has classified major liquid waste streams from the reprocessing plant in the state as RCRA-exempt mixed waste. A Washington State official responsible for enforcing state dangerous waste regulations told us the data provided him were inadequate to characterize the chemical and radioactive elements in the waste. As a result, he does not know whether DOE's classification is proper. Further, Washington State officials believe DOE, under its proposed rule, will have broad discretion in excluding major streams from RCRA jurisdiction. Some other state officials have expressed similar concerns about DOE's characterization of its waste.

Recognizing the uncertain resolution of the question, DOE's Office of the Assistant Secretary for Environment, Safety, and Health, in March 1986 began a policy review of the mixed waste question. DOE has not established a time frame for completing this policy review.

Conclusions

All nine DOE facilities we reviewed are changing the way they handle, dispose, or release waste material they produce in order to come into compliance with environmental laws. Four DOE facilities are not in full compliance with the Clean Water Act. DOE has projects underway—which will cost more than $60 million—to bring these facilities into full compliance. Unresolved environmental problems at the N-Reactor in Washington State and Feed Materials Production Center in Ohio could substantially raise the cost to get these facilities in full compliance. DOE has more extensive efforts underway to get its facilities final permits under RCRA. These include closing and cleaning up disposal facilities as well as building facilities to treat waste prior to disposal. DOE could spend more than $200 million at these facilities to close and clean up existing disposal facilities and build additional treatment facilities.

The eventual cost to get these facilities in full compliance with the Clean Water Act and final permits under RCRA may be substantially higher depending on how site-specific environmental issues are resolved. For example, to address the thermal discharge issue at the N-Reactor, DOE is

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examining alternatives, such as building cooling water facilities, which could cost $150 million. Groundwater cleanup may be required at DOE sites as part of the RCRA permit process. According to DOE officials, such cleanup costs can amount to hundreds of millions of dollars at a single site.

We believe that getting DOE facilities into compliance with applicable environmental laws could have significant budgetary impacts—perhaps over a billion dollars. Because of the budget implications and the significance of the issues that need to be resolved, we believe the Congress should be kept fully informed of DOE's efforts in bringing its facilities into full compliance with applicable environmental laws. Such information is important to highlight the potential budgetary ramifications and time frames necessary to resolve environmental issues at DOE defense facilities. Accordingly, we believe DOE should provide the Congress with a comprehensive report setting forth DOE's plans, milestones, and cost estimates for bringing its facilities into compliance.

The existing permit process under the Clean Water Act and RCRA appears to be an adequate structure for ensuring that waste is properly handled. However, we are concerned that some portion of DOE's mixed waste may be exempt from RCRA jurisdiction and, hence, outside the permit process. In addition, DOE's existing order governing hazardous and mixed waste has become outdated and needs to be revised to better reflect how such waste should be handled.

DOE has published a draft rule that would exempt from RCRA regulation mixed waste generated as a direct consequence of making special nuclear material. Under the rule, DOE would continue to regulate this waste. At some facilities, such as the N-Reactor in Washington State, all major liquid waste streams would eventually be exempt. As a result, the disposal of such waste would not be subject to independent inspections by EPA and/or the state. In our view, independent inspections are important to show the public and the Congress that such waste will be disposed in an environmentally acceptable manner. At a minimum, DOE should allow independent inspections of its disposal practices for any mixed waste that may eventually be exempt from RCRA regulation. Such independent inspection would help assure the public and the Congress that the waste is managed with the same degree of protection as that offered under RCRA.

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Finally, DOE's existing order on hazardous and mixed waste— DOE Order 5480.2—is outdated. This order does not recognize EPA and state government jurisdiction of hazardous waste activities at DOE defense facilities. We believe the order should be revised to reflect how DOE waste operations will be managed in the future.

Recommendations

We recommend that the Secretary of Energy take the following actions:

- Provide to the Congress a comprehensive report setting forth DOE's plans, milestones, and cost estimates for bringing DOE defense facilities into compliance with all applicable environmental laws.
- Provide for independent inspections of DOE operations in regard to the treatment and disposal of any mixed waste that may be exempt from RCRA regulation.
- Revise DOE Order 5480.2 governing hazardous and mixed waste to reflect how waste operations will be managed in the future.

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Strengthening DOE's Environmental Protection, Safety, and Health Programs

Over the last 5 years, we have issued several reports identifying organizational and procedural problems that have impaired DOE oversight of environmental, safety, and health (ES&H) issues. Similarly, DOE has carried out studies that have argued for the need to enhance its existing programs for protecting the environment around, and workers at, DOE facilities. Both DOE internal reports and our reports have pointed out the need to strengthen ES&H oversight of DOE operations.

On September 18, 1985, the Secretary of Energy announced several initiatives to strengthen ES&H programs within DOE. Among other things, these initiatives included (1) reorganizing the ES&H functions at DOE headquarters, (2) revising ES&H orders, and (3) conducting a comprehensive environmental survey and technical safety appraisals at DOE facilities. These initiatives, once fully implemented, have the potential to strengthen DOE headquarters oversight of ES&H matters in regard to DOE operations.

Previous Reports on DOE's ES&H Programs

Since 1980, GAO and DOE have issued several reports recommending improvements in DOE's ES&H activities. Although the scope of these studies has varied, each report has observed weaknesses in the way DOE manages specific ES&H activities. Many of the studies reached similar conclusions—that DOE's overall organization and management of ES&H issues needed to be strengthened.

In July 1980 we reported that DOE's program to protect the safety and health of employees at its uranium enrichment plants has not been fully implemented by DOE's Oak Ridge Operations office.[1] We pointed out in this report that appraisals and inspections of plant conditions are not as frequent and/or thorough as required. We also found that dual responsibilities of the operations office—production and safety and health—limits its ability to independently and objectively administer a safety and health program.

In August 1981 we reported that major changes are required in the safety and health oversight program of DOE nuclear facilities to ensure that environmental, safety, and health standards are met.[2] Among other

[1]Department of Energy's Safety and Health Program For Enrichment Plant Workers Is Not Adequately Implemented (EMD-80-78, July 11, 1980).

[2]Better Oversight Needed For Safety and Health Activities At DOE's Nuclear Facilities (EMD-81-108, Aug. 4, 1981).

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things, we found that DOE has little assurance that information concerning radiological releases from DOE's nuclear facilities is accurate and reliable. We also noted that DOE needs to complete safety analysis reviews for its older facilities to ensure that they meet current safety standards. In this report we recommended a reorganization of DOE's safety and health programs as well as other actions to correct program deficiencies.

In November 1983 we reported that, although DOE has improved its health and safety programs since the 1981 report, it had not addressed what we believed to be the major cause of the problems— the organizational structure.[3] We emphasized again that DOE's safety and health functions could be reorganized to provide greater authority and independence to ensure that DOE operations are carried out in an environmentally acceptable manner and protect worker health and safety.

In December 1985 we reported that (1) the three plants in Ohio have several environmental problems, such as groundwater contamination, (2) radiological monitoring guides are not always followed at these plants, (3) some of these plants did not fully implement DOE's environmental monitoring guide and DOE's As Low As Reasonably Achievable policy for radioactive releases and exposures.[4] We recommended that DOE make radiological guides mandatory for all facilities and establish a system to independently verify contractor-reported environmental release data.

In June 1986 we reported on DOE's process for conducting safety analysis reviews for its defense facilities.[5] We found that some safety analysis reports for operating facilities have not been approved, the approaches used in the reviews to demonstrate the safety of the facilities significantly differ, and the overall review process is an internal DOE function. We made a number of recommendations to improve the process within DOE, and also recommended that arrangements be made with an outside independent organization to review safety reports for the most hazardous facilities.

[3]DOE's Safety and Health Oversight Program at Nuclear Facilities Could Be Strengthened (GAO/RCED-84-50, Nov. 30, 1983).

[4]Environment and Workers Could Be Better Protected at Ohio Defense Plants (GAO/RCED-86-61, Dec. 13, 1985).

[5]Safety Analysis Reviews for DOE's Defense Facilities Can Be Improved (GAO/RCED-86-176, June 16, 1986).

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Between March 1981 and April 1985, DOE issued two studies on its ES&H activities. In the first study, DOE commissioned a task force to examine the operational safety of its nuclear reactors. This task force study was issued in March 1981. Four years later, the Secretary of Energy requested a member of the original task force, Dr. James Kane of the University of California, to reevaluate the organization and management of DOE's ES&H programs. This study, referred to as the Kane study, was sent to the Secretary in April 1985. Both DOE studies called for changes in the way DOE is organized and in the manner it carries out its ES&H programs.

The March 1981 task force found that (1) DOE's headquarters policies, instructions, and other information issued to field offices were undefined or applied differently under various DOE programs, (2) headquarters had no directives promulgating requirements for emergency preparedness or public notification in accident situations, and (3) DOE did not have a coordinated Department-wide program to implement the lessons learned from Three Mile Island. The task force recommended strengthening the DOE line organizations responsible for reactor operations and safety oversight and suggested establishing new safety groups inside and outside DOE to monitor overall nuclear safety performance.

The April 1985 evaluation of DOE's ES&H functions reiterated many of the findings in previous DOE and GAO reports. In this evaluation, Dr. Kane concluded that DOE's basic philosophy of having program offices and central ES&H organization share responsibilities for nuclear safety was sound. However, he observed that DOE's ES&H organization was perceived as having "no clout" and of sometimes being ignored by senior management. To ensure that DOE's separation of ES&H responsibilities works, Dr. Kane recommended that DOE reorganize and revitalize its ES&H activities. Specifically, he called on DOE to (1) consolidate the program offices' ES&H activities into a central ES&H activity, (2) elevate the organizational placement of the central ES&H activity, (3) designate a Department Safety Officer, and (4) issue revised ES&H orders reflecting the new organization. To improve the day-to-day effectiveness of this organization, he recommended that DOE reorientate its process for appraising field offices' effectiveness by emphasizing the adequacy of actual conditions at facilities, rather than the current emphasis of focusing on the "paper trail" of records and inspections that indirectly describes these conditions.

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DOE's September 1985 ES&H Initiatives

On September 18, 1985, the Secretary of Energy announced several initiatives to consolidate and upgrade the Department's oversight of ES&H activities. The initiatives are (1) reorganizing the ES&H activities at DOE headquarters, (2) revising ES&H orders, (3) conducting a major environmental survey of conditions at DOE sites, (4) carrying out major technical safety appraisals of conditions at DOE's nuclear facilities, (5) revising ES&H information reporting and tracking systems, (6) increasing environmental guidance, and (7) enhancing the professional development of ES&H staff. In addition to the initiatives, the Secretary of Energy in January 1986 issued an Environmental Policy Statement. This policy commits DOE to ensuring that national environmental protection goals are incorporated in the formulation and implementation of DOE programs.

The reorganization elevates overall ES&H responsibilities and changes the internal structure of DOE's headquarters ES&H activities. Headquarters ES&H activities are now under an Assistant Secretary for Environment, Safety, and Health rather than a Deputy Assistant Secretary. The new Assistant Secretary reports directly to the Under Secretary of Energy. Within the new office, DOE created a new position of Deputy Assistant Secretary for Environment, with three directors responsible for environmental guidance; environmental analysis; and environmental audit and compliance activities. The new office also has a Deputy Assistant Secretary for Safety, Health, and Quality Assurance, with three directors responsible for occupational safety, nuclear safety, and quality assurance, respectively. As of March 1, 1986, the reorganization was essentially complete.

The new ES&H office's authority over DOE operations should be strengthened with the initiative to revise DOE's operating orders. The following DOE orders are in the process of being revised:

- Environmental, safety, and health programs for DOE operations (Order 5480.1A): This order delineates DOE headquarters and field office responsibilities for implementing DOE's ES&H programs.
- Safety of reactors and other nuclear facilities (Orders 5480.5 and 5480.6): These orders set forth controls for preventing nuclear accidents and releases of radioactive material.
- Preparation and review of safety analysis reports (Order 5481.1B): This order establishes DOE's requirements for reports that identify potential safety hazards at facilities and evaluate alternative actions to eliminate or mitigate these hazards.

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- The ES&H appraisal process (Order 5482.1B): This order establishes a hierarchical system of reviews for evaluating the ES&H performance of contractors and field offices.
- Quality assurance requirements (Order 5700.6B): This order assigns responsibilities for establishing, implementing, and maintaining programs intended to optimize equipment reliability and personnel performance at all facilities.

The new orders, as drafted, would strengthen DOE's ES&H office. Some of the more significant proposed changes provide for the concurrence of DOE's ES&H office with program offices (e.g., defense programs) in matters related to ES&H guidance given to field offices, in approving field office ES&H programs, and in approving generic (DOE-wide) exceptions to DOE ES&H requirements. Previously, DOE's ES&H office could review and make suggestions, but there was no requirement that they approve or concur. In addition, under the proposed new orders, the new ES&H office can formally recommend that the cognizant field office curtail or suspend operations because of undue ES&H risks. Finally, according to DOE officials, the new proposed orders will encourage headquarters ES&H staff to perform more hands-on inspections and appraisals of DOE contractors. Previously, DOE headquarters appraisals focused on reviewing DOE's field office appraisal system. DOE officials told us they expect to issue the approved orders in September 1986.

To identify specific problems at DOE facilities and set priorities for corrective action, the Secretary also launched two efforts—an environmental survey and technical appraisals—to assess the extent of environmental and nuclear safety problems at its nuclear facilities. The efforts are separate in that they each involve different ES&H staff, issues, and schedules. However, they share a common methodology and purpose.

DOE's environmental survey and technical safety appraisals are long-term, Department-wide efforts involving teams of ES&H staff and contractors. The environmental survey will examine existing and potential air, water, and soil contamination at all DOE facilities, using environmental specialists led by ES&H Office of Environmental Audit and Compliance staff. The technical safety appraisal teams, lead by the ES&H Office of Nuclear Safety staff, will examine reactor safety, radiation exposure controls, and other topics at 51 DOE nuclear facilities. Both efforts involve similar work steps and products. Survey and appraisal teams will review site-specific background information prior to their visit to a location; interview personnel and directly observe facility

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practices at a site; and develop an interim report on each facility. DOE also plans to issue summary reports on the overall survey and appraisal efforts, which it can use to establish priorities for correcting any problems identified.

DOE started field work on the technical safety appraisals in February 1986. Field work has been completed at both the Fast Flux Test Facility in Washington State and the Feed Materials Production Center plant in Ohio. The completion of all the technical safety appraisals is scheduled for early 1989. The field work for the environmental survey began in June 1986 at the Feed Materials Production Center plant. All the environmental surveys are scheduled to be completed in late 1988.

DOE's ES&H initiatives also include several efforts to enhance its overall program management capabilities. It plans to (1) develop a computerized information system containing environmental and safety data on all DOE facilities, (2) issue more timely environmental guidance to field and program offices, and (3) provide education and professional development programs to ES&H and field staff.

The program's planned computer information system is an effort to improve DOE's ES&H reporting requirement while capturing the results of the new environmental surveys and technical appraisals. According to DOE officials, information concerning facilities' problems and corrective actions will be maintained to monitor DOE's cleanup efforts and prioritize ES&H oversight concerns. The system will be developed by ES&H's Office of Budget and Administration.

DOE's environmental guidance initiative is aimed at evaluating developing regulatory issues that could affect DOE in the near future. DOE's objective in this area is to assess the potential impact of environmental legislation and other emerging regulatory issues early enough so that it can provide program and field offices sufficient time to meet guidelines that regulatory agencies may impose. As part of this initiative, DOE has established a process for coordinating and resolving DOE environmental compliance issues.

In the professional development effort, DOE's goal is to improve the staff's expertise and credibility and create a professional atmosphere conducive to hiring and maintaining the best environmental, safety, and health specialists. They plan to do this by increasing ES&H's training budget and having headquarters and field staff jointly participating in training courses.

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According to DOE officials, none of the ES&H initiatives is designed to decrease the responsibilities of DOE's program offices (e.g., defense programs), field offices, and contractors in carrying out DOE operations in a safe and environmentally acceptable manner. DOE's field offices and contractors will retain the responsibility for carrying out their own ES&H activities in accordance with DOE orders and policies. Furthermore, DOE program offices will continue to be primarily responsible for implementing DOE's ES&H program. This responsibility includes confirming that DOE and federal ES&H policies and directives are followed continuously in all DOE operations. In addition, under new DOE draft orders, DOE program offices will remain responsible for preparing budget proposals that provide resources for corrective action and will retain authority to curtail and suspend operations because of undue risks.

Conclusions

Since 1980, GAO and DOE have issued reports recommending improvements in DOE's ES&H activities. Many of these reports reached similar conclusions that DOE's ES&H functions need to be strengthened and made more independent from DOE's program offices, which are responsible for carrying out DOE activities. DOE's September 1985 initiatives are aimed at strengthening ES&H oversight within DOE at the headquarters level.

In our view, DOE's initiatives provide a framework for improving ES&H oversight. DOE's program offices have retained primary responsibility for implementing ES&H programs and thus can make them an integral part of their day-to-day operations. The reorganization, which is essentially complete, gives more visibility to ES&H activities within DOE and establishes a more direct line of communication between the new Assistant Secretary for Environment, Safety, and Health and the Secretary of Energy. This is an important first step in developing a more independent oversight office within DOE. DOE has also issued an environmental policy that more clearly establishes DOE's environmental obligations. Other initiatives, such as the draft orders, give increased authority to the new Assistant Secretary to oversee ES&H activities within DOE. However, these orders have not yet been finalized. Finally, some key initiatives—the environmental surveys and the technical safety appraisals—can provide important information on problems facing DOE, but are not sufficiently implemented to assess the impact they might have on strengthening DOE ES&H activities.

DOE's new ES&H office, while offering the potential for strengthening oversight, remains an internal DOE function. Thus, problems identified in

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previous reports—conflicts from program offices in establishing priorities between programmatic goals and ES&H activities—can still occur. We believe it could take years before an objective assessment can be made as to whether DOE's new office is sufficiently independent in bringing important ES&H matters to the attention of the Secretary of Energy and the Congress. In certain areas, we believe outside independent oversight can be beneficial. For example, we continue to believe—as stated in a recent GAO report that outside independent reviews of DOE safety analysis reports would better assure the public and the Congress that DOE's facilities are safe. In this report we are recommending that DOE provide for outside independent inspections of DOE operations in regard to the treatment and disposal of any mixed waste that may be exempt from RCRA regulations.

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